Randomly Censored Poisson (Experimental)

Parametrisation

The Poisson distribution is

$$\text{Prob}(y) = \frac{\lambda^y}{y!}\exp(-\lambda)$$

for responses $y = 0, 1, 2, \ldots$, where λ is the expected value.

The randomly-censored Poisson allow the observations to have a known or unknown censoring: `event`$= 1$ its observed as is, with `event`$= 0$ its right censored, so the likelihood is

$$\text{Prob}(Y \geq y) = \sum_{y' \geq y} \frac{\lambda^{y'}}{y'!}\exp(-\lambda),$$

and for `event` $\neq 0, 1$ (after rounding from double to int) then its randomly censored where

$$\text{Prob}(\text{event} = 1) = p(\cdot)$$

and

$$\text{Prob}(\text{event} = 0) = 1 - p(\cdot)$$

where $p(\cdot)$ depends on covariates

$$\text{logit}(p(\cdot)) = \text{offset} + \sum_{i=1} \beta_i x_i$$

Link-function

The mean λ is linked to the linear predictor by

$$\lambda(\eta) = E\exp(\eta)$$

where $E > 0$ is a known constant (or $\log(E)$ is the offset of η).

Hyperparameters

$\beta_1, \beta_2, \ldots$ if in use. Maximum 10.

Specification

- `family="rcpoisson"`
- Data are given as an `inla.mdata`-object, with format

  $$\text{inla.mdata}(y, E, \text{event}, \text{offset}, x_1, x_2, \ldots)$$

  where maximum 10 covariates can be given. Each argument is a vector. Note that the four first columns are required, and the covariates can be omitted if there are none.

Hyperparameter spesification and default values

doc `Randomly censored Poisson`

hyper

theta1

hyperid 66701
name beta1
short.name beta1
output.name beta1 rcpoisson observations
output.name.intern beta1 rcpoisson observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta2

hyperid 66702
name beta2
short.name beta2
output.name beta2 rcpoisson observations
output.name.intern beta2 rcpoisson observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta3

hyperid 66703
name beta3
short.name beta3
output.name beta3 rcpoisson observations
output.name.intern beta3 rcpoisson observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta4

hyperid 66704
name beta4
short.name beta4
output.name beta4 rcpoisson observations
output.name.intern beta4 rcpoisson observations
initial 0
fixed FALSE
prior normal

param 0 100
to.theta function(x) x
from.theta function(x) x

theta5

hyperid 66705
name beta5
short.name beta5
output.name beta5 rcpoisson observations
output.name.intern beta5 rcpoisson observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta6

hyperid 66706
name beta6
short.name beta6
output.name beta6 rcpoisson observations
output.name.intern beta6 rcpoisson observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta7

hyperid 66707
name beta7
short.name beta7
output.name beta7 rcpoisson observations
output.name.intern beta7 rcpoisson observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta8

hyperid 66708
name beta8
short.name beta8
output.name beta8 rcpoisson observations

output.name.intern `beta8 rcpoisson observations`
initial `0`
fixed `FALSE`
prior `normal`
param `0 100`
to.theta `function(x) x`
from.theta `function(x) x`

theta9

hyperid `66709`
name `beta9`
short.name `beta9`
output.name `beta9 rcpoisson observations`
output.name.intern `beta9 rcpoisson observations`
initial `0`
fixed `FALSE`
prior `normal`
param `0 100`
to.theta `function(x) x`
from.theta `function(x) x`

theta10

hyperid `66710`
name `beta10`
short.name `beta10`
output.name `beta10 rcpoisson observations`
output.name.intern `beta10 rcpoisson observations`
initial `0`
fixed `FALSE`
prior `normal`
param `0 100`
to.theta `function(x) x`
from.theta `function(x) x`

status `experimental`

survival `FALSE`

discrete `TRUE`

link `default log`

pdf `rcpoisson`

Example

In the following example we estimate the parameters in a simulated example with Poisson responses.

```
n <- 30000
x <- rnorm(n)
eta <- 1 + 0.2 * x
event <- rep(1, n)
E <- runif(n)

offset <- rnorm(n, sd = 0.5)
xx <- rnorm(n)
xxx <- rnorm(n)
eta.c <- offset + 0.3 * xx + 0.5 * xxx

## need two for the censoring
y <- rpois(n, E*exp(eta))
yy <- rpois(n, E*exp(eta))

for(i in 1:n) {
    event[i] <- sample(c(1, 0, 99), 1, prob = c(0.6, 0.1, 0.3))
    if (event[i] == 1) {
        ## y[i] <- y[i]
    } else if (event[i] == 0) {
        y[i] <- min(y[i], yy[i])
    } else {
        prob <- 1/(1+exp(-eta.c[i]))
        if (runif(1) < prob) {
            ## local.event = 1
            ## y[i] <- y[i]
        } else {
            ## local.event = 0
            y[i] <- min(y[i], yy[i])
        }
    }
}

Y <- inla.mdata(y, E, event, offset, xx, xxx)
r <- inla(Y ~ 1 + x,
          data = list(Y = Y, x = x),
          family = "rcpoisson",
          control.family = list(hyper = list(beta1 = list(param = c(0, 1)),
                                             beta2 = list(param = c(0, 2)))),
          verbose = !TRUE)
summary(r)
```

Notes